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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/655,482	09/04/2003	Wei-Chih Wang	UNIV0185	5872

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LAW OFFICES OF RONALD M. ANDERSON
Suite 507
600 - 108th Avenue N.E.
Bellevue, WA 98004

EXAMINER

HORWAT, JENNIFER A

ART UNIT	PAPER NUMBER
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3768

DATE MAILED: 08/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

JP

Office Action Summary	Application No. 10/655,482	Applicant(s) WANG ET AL.	
	Examiner Jennifer Horwat	Art Unit 3768	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 10-58 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 10-58 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/13/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 4/26/06 have been fully considered but they are not persuasive.

Regarding claim 1, Boppart discloses an imaging system in which the imaging engine may be optical coherence tomography, but may also be other interferometric imaging systems, fluorescence or other spectroscopic imaging systems, Raman imaging, diffuse wave optical imaging, or two photon imaging systems (col 4, lines 39-44) and further includes other imaging sub-systems, such as display (col 4, line 48). The system further includes a waveguide within the cantilever that undergoes transverse scanning (figure 23a and col 34 lines 40-45). Further, as stated in claim 1, Boppart discloses an optical imaging system which includes a sample illuminator which illuminates a sample, or conveys light, and a probe housing which includes scanning mechanisms causing the light to scan the sample, in which the illuminator is "at least partially located within said housing".

Regarding the sensing of motion, the position of interest is the location of the distal end which allows proper alignment of the cantilever with the illumination target. The sensing mechanisms determine relative motion, direction, and velocity, and are located at the distal end of the cantilever (col 13, lines 44-45). The device is then translated under control of an actuator to cause the cantilever to move to a desired position. Therefore, it can be said that the position sensor detects the position of the

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free end of the cantilever, at the very least as part of the cantilever as a whole, and is under the control of an actuator to cause the cantilever to move in a desired motion, as claimed.

Applicant's arguments with respect to claim 20 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-5, 8-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Boppart, et al (US 6485413). Boppart discloses an apparatus for displaying an image (figure 4b) with a light source (col 2, line 43) of an optical fiber, a substrate (col 15, line 16), a piezoelectric cantilever (col 11, lines 59-60) that is fixed on one end and is free to move on the other in response to an actuator (col 5, line 7), and a position sensor for detecting position of the cantilever and the optical fiber and instructs the control computer as to the desired position (col 13, lines 34-38). The position sensor comprises a fiber bundle displacement sensor (fig. 5b). The optical fiber is attached to the cantilever (figure 4c, elements 58 and 94) wherein the cantilever serves as a

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waveguide. A detector is used to generate a signal in response to detected light (col 2, line 45). A focusing gradient index lens (GRIN) is attached at the free end of the cantilever (figures 4a-4f). The light source comprises white light and a tunable optical filter (col 6, line 11) is used to provide color spectrum including either grating filters or prisms (col 6, line 25). The use of a prism inherently provides a plurality of color elements. The device is of a size and structure that it may be enclosed in a variety of medical devices by a flexible sheath, such as an endoscope (col 28, line 52) or a biopsy tool (figure 27). Waveguides are commonly made of silicon-based material, such as silicon oxide (col 34, line 46). The cantilever, which is referred to as the fiber/lens unit, is capable of moving at very high lateral velocities and may be displaced at its resonant frequency (col 13, lines 12-27). The biopsy tool has a very small blade with a diameter of 1-5 mm, and the imaging device may be placed within the biopsy blade (col 38, lines 18-26). Therefore, at least two dimensions of the device, such as height and width, would be contained within this diameter making it less than the 1-5 mm of the cylindrical blade. Additionally, Boppart discloses that using a phased array allows the angle that may be scanned over to be determined and the far-field pattern (col 13, lines 56-58). The imaging may include a variety of embodiments including photon imaging systems (col 4, line 43).

Claim 8 is merely a product by process claim and therefore the process by which by which the cantilever is formed does not add any limitation to the structure of the cantilever itself.

Boppart teaches all the structures as set forth above. The method concerning the steps of forming and using the device are considered inherently taught by the disclosure.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boppart in view of Bennett (US 52091174). Boppart, as discussed above, substantially discloses the invention as claimed. However, Boppart fails to disclose that the cantilever used in the system is tapered. Bennett discloses micromachined cantilever beams for sensors built on substrates and teaches that "rectangular cantilever beams display inferior performance to tapered cantilever beams" (col 3, lines 4-5) and that tapered cantilever beams absorb more elastic energy than rectangular cantilever beams and allow for a greater deflection in response to movement, vibration, or acceleration. It is therefore inherent that the vibrational characteristics of a beam are dependent on the structure of the beam itself. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the disclosure of Boppart in view of the teaching of a tapered cantilever by Bennett, as Bennett clearly states that rectangular cantilevers are inferior to tapered ones.

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5. Claims 20-24, 27-40, 42-45, 47-56, 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boppart in view of Farah (US 663998 or US 20040033006). Boppart discloses an apparatus for displaying an image (figure 4b) with a light source (col 2, line 43) of an optical fiber, a substrate (col 15, line 16), a piezoelectric cantilever (col 11, lines 59-60) that is fixed on one end and is free to move on the other in response to an actuator (col 5, line 7), and a position sensor for detecting position of the cantilever and the optical fiber and instructs the control computer as to the desired position (col 13, lines 34-38). The position sensor comprises a fiber bundle displacement sensor (fig. 5b). The optical fiber is attached to the cantilever (figure 4c, elements 58 and 94) wherein the cantilever serves as a waveguide. A detector is used to generate a signal in response to detected light (col 2, line 45). A focusing gradient index lens (GRIN) is attached at the free end of the cantilever (figures 4a-4f). The light source comprises white light and a tunable optical filter (col 6, line 11) is used to provide color spectrum including either grating filters or prisms (col 6, line 25). The use of a prism inherently provides a plurality of color elements. The device is of a size and structure that it may be enclosed in a variety of medical devices by a flexible sheath, such as an endoscope (col 28, line 52) or a biopsy tool (figure 27). Waveguides are commonly made of silicon-based material, such as silicon oxide (col 34, line 46). The cantilever, which is referred to as the fiber/lens unit, is capable of moving at very high lateral velocities and may be displaced at its resonant frequency (col 13, lines 12-27). The biopsy tool has a very small blade with a diameter of 1-5 mm, and the imaging device may be placed within the biopsy blade (col 38, lines 18-26). Therefore, at least

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two dimensions of the device, such as height and width, would be contained within this diameter making it less than the 1-5 mm of the cylindrical blade. Additionally, Boppart discloses that using a phased array allows the angle that may be scanned over to be determined and the far-field pattern (col 13, lines 56-58). The imaging may include a variety of embodiments including photon imaging systems (col 4, line 43).

Claim 27 is merely a product by process claim and therefore the process by which by which the cantilever is formed does not add any limitation to the structure of the cantilever itself.

Boppart fails to disclose that the image acquisition system is configured as a micro-electro-mechanical system (MEMS). However, Farah discloses a system for an optical waveguide, as is used in the system of Boppart, and further discloses that it is known in the art that optical waveguide devices are typically made on silicon substrates (paragraph 3). These cantilevered film waveguides (paragraph 5) may be constructed as MEMS devices and fabricated on silicon wafers (paragraph 13). The MEMS structure includes a thick substrate and a thin piezoelectric layer, which constitute the thick and thin layers (paragraph 44). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the disclosure of Boppart in light of the disclosure of Farah to configure the apparatus as a micro-electro-mechanical system, as a MEMS device allows a small structure (on the order of microns) which allows the device to be used in a variety of devices such as probes, endoscopes, and other minimally invasive devices.

6. Claims 25, 26, 41, 46, and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boppart in view of Farah as applied to claims 20 and 43 above, and further in view of Bennett (US 52091174). Boppart in view of Farah, as discussed above, substantially discloses the invention as claimed. However, Boppart in view of Farah fails to disclose that the cantilever used in the system is tapered. Bennett discloses micromachined cantilever beams for sensors built on substrates and teaches that "rectangular cantilever beams display inferior performance to tapered cantilever beams" (col 3, lines 4-5) and that tapered cantilever beams absorb more elastic energy than rectangular cantilever beams and allow for a greater deflection in response to movement, vibration, or acceleration. It is therefore inherent that the vibrational characteristics of a beam are dependent on the structure of the beam itself. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the disclosure of Boppart in view of Farah further in view of the teaching of a tapered cantilever by Bennett, as Bennett clearly states that rectangular cantilevers are inferior to tapered ones.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer Horwat whose telephone number is (571) 272-2811. The examiner can normally be reached on M-Th 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eleni Mantis-Mercader can be reached on (571) 272-4740. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

jah
7/21/06


BRIAN L. CASLER
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3700